standard. For the time being, TRAC recommends a handset that can switch between the higher performing digital service and analog cellular.

Privacy and Security. Which standard is most secure?

Consumers are concerned about how secure their cellular service is. No one wants other people to be able to listen in on their private calls. And cellular phones haven't always been known for providing the security from theft that consumers expect from their telephone service.

Everyone knows how simple it is to zero in on a radio signal, we do it every day in our cars without looking. The technology used in analog cellular transmission is similar to that of a typical radio. Digital promises to eliminate the possibility of others eavesdropping in on conversations or stealing the code that your phone uses to access the system.

Digital technology converts sound into long lists of 1's and 0's and then transmits them to the cell. Analog technology converts sound into waves that can be easily duplicated. Analog waves are much easier and simpler to intercept and copy than a stream of 1's and 0's.

Both TDMA and CDMA technologies send out lists of 1's and 0's in an encoded packet. There are so many potential codes that it is impossible to determine which one is being used.[17] CDMA was originally developed for military use to increase security in communication and uses over 4.4 trillion variable codes during any conversation. The difference between TDMA and CDMA is that the CDMA code is scrambled while the TDMA code repeats in sequence, making it less secure. CDMA is the most secure of the digital technologies and of all the cellular services, analog is clearly the most susceptible to theft and tapping.

You should be aware that dual-mode phones, which switch between digital and analog, are susceptible to signal theft when they roam into an area that can only access analog service. As a result, an authentication procedure requiring you to input a PIN code may be used outside of the digital network. Therefore, dual-mode phones are not as secure as pure digital phones.

[17]CDMA transmits the digital series in a scrambled block (some digits are flipped, some are not) encoded with a pseudo-random code. Theoretically, there are an infinite number of codes to be used. Without the code, it is virtually impossible to determine what the streams of 1's and 0's mean. ("Wireless Data." Technical Reference Infobase. Zoom Telephonics, Inc. http://www.modems.com/glossary/glos22.htm).

Enhanced Services. Which technology has the ability to offer the most services that consumers want?

Convenience is the key reason that people use cellular phones. They want to be in contact whenever they choose, wherever they go. Different features and services can also make cellular calling more convenient. Consumers can expect these types of services from their digital phones.

Some of the features common to digital phones include: call waiting (the user is notified that a second call is coming through while on line with a first), conference calling (multiple parties included in the same call), Caller-ID (notifies user of the originating number from the incoming call), short messaging (SMS), and voice messaging. Some providers will package these services into an integrated service, some may separate the services into "pick-and-choose" options, and others may provide all these services as part of a basic service plan. Digital providers typically offer these services as part of a basic service.

Another feature common with digital service is first minute of incoming calls free. This is an exceptional value for consumers. Most cellular calls tend to be short and to the point because they cost more than land-line calls. Some consumers will even leave their phones off so that they don't receive unwanted calls. This feature and the extended standby times offered by digital systems allow consumers to leave their phone on longer and not miss a call.

Consumers should decide which features they want and which fit into their budget. Analog service has the ability to offer the same services as those that characterize digital, but usually doesn't. If offered, most of these services will typically have an extra charge. TRAC predicts that as analog providers lose more customers to digital providers, they will offer these services at a competitive price, if not for free.

Power Requirements. How do the power requirements for a technology affect the quality of service?

One of the most common complaints about cellular phones is short battery life. Some phones will allow you to talk for only 30 minutes to an hour before having to recharge the battery. And then, it takes upwards of twelve hours to get the battery fully charged before you can use it again. Technology plays an important role in determining power requirements. Analog cellular requires a significant amount of power to operate which is why the battery life is so short. TDMA and GSM use a strong, concentrated signal to ensure quality. This approach requires less power than analog but more than CDMA. CDMA operates with a low-level, uniform power, which allows for more conservation of the battery.[18]

CDMA's use of power relates back to the "bus" analogy. If one person was to shout on a bus full of people participating in separate conversations, the rest of the conversations would be drowned out. With CDMA, everyone talks at the same volume to avoid this. The same goes for everyone using a cell in the CDMA network. The power is regulated so that all users of a cell transmit at levels that are equal when they reach the cell. Those who are closer to the cell site will transmit at lower power levels, those further away at higher power levels. Even when CDMA phones are transmitting at the highest levels possible, it is still much lower than the power required for GSM, TDMA and analog transmission.[19]

---

[18]Krapf, Eric. "Get the Bugs Out." America's Network. July 1, 1996. http://www.americasnetwork.com.

[19]CDMA uses electric circuitry in the cell site that adjusts the power of the mobile unit more than 800 times a second. The site instructs the mobile unit to operate at the lowest feasible level. This provides the most efficient use of the

One of the goals of digital technology was to create a smaller, lighter phone. This has been made possible because digital service requires less power and the newer batteries operate more efficiently. Not only are the digital phones lighter, they also provide longer use time before recharging. Digital technologies benefit from much longer standby and talk times than analog. Consumers using digital technology will see marked improvements in battery performance.

Voice Quality. Which standard provides the best-sounding voice quality?

Consumers expect the best sound possible from their cellular phones. Improvements in technology have made it possible to achieve land-line-like quality. Digital technology has given design engineers a means to make this possible.

One factor affecting sound quality in digital service is the voice encoder, otherwise known as a vocoder. This is the device that translates audible tones (your voice) into digital transmissions. Vocoders used for digital systems approach the highest speed of translation possible. CDMA phones use better sounding vocoders with higher data transmission rates, which result in better sound quality.[20] GSM and TDMA sometimes use slower (lower quality of sound) vocoders in order to free up room for more usage capacity, something unnecessary for CDMA because of its expanded capacity.[21]

In a recent article it was observed that CDMA yields a sound quality only 6% worse than wire-line service, while TDMA scored 11% worse and GSM 23% poorer than land-line calls.[22] Only CDMA corrects every bit, and the result is a much higher voice quality.

---

battery in the mobile phone. This regulation of the battery is necessary to prevent signals closer to the cell site from drowning out signals originating further away. CDMA averages at 2mW while GSM averages 600mW. (Gilder, George. "Could 'Charles' Upend McCaw?" *Forbes ASAP*. March 29, 1993.)

[20] because more data can be transmitted

[21] Vocoders are rated on how many 1's and 0's (bits) can be translated per second. The highest threshold is 14.4 kbps. The higher the rate of translations, the better the quality. It also follows that the higher the rate of translations, the more information to be transmitted, thus requiring more capacity. PCS technologies are capable of operating with a 13 kbps vocoder. Not all digital phones operate at this speed because of the amount of capacity required to provide this level of service. New vocoders are being developed that take advantage of silent periods and voice-energy fluctuations to create a variable rate, delivering high-quality voice without decreasing system capacity ("CDMA, PCS1900, and TDMA Vie for PCS." *EDN Magazine*. November 21, 1996. Pages 72-73).

[22] Edmont, Philip, *The Financial Post*. March 29, 1997

Signal Quality. Which standard provides the best signal?

Interference is also a major consideration when selecting a service. Because CDMA transmits on a wider-spread spectrum, sending the signal over a broader range than the direct, narrow signal sent out by TDMA, GSM and analog phones, it is able to better deal with crowded downtown areas and hilly areas that have traditionally resulted in echoes or signal loss.[23]

Digital technology provides better reception quality compared to analog, and among the digital technologies, CDMA's broader range transmission seems to have the advantage.

Reliability. Which standard can I rely on when I am having a vital conversation or I am waiting for an important call?

Have you ever turned a corner in your car while on a call, only to hear fuzz and a click signaling that your call was lost? Have you ever urgently tried to make a call on your analog cellular phone, only to get a busy signal or that irritating "We're sorry, all circuits are busy" message? Most analog cellular phone users have experienced problems with dropped calls or clogged frequencies that won't let a call get through. Digital technology promises to do away with these irritations.

When a cellular phone is in use, it is in constant contact with the cell. A cell only has a certain range in which it can communicate with a mobile phone. As the user travels further away from one cell, he or she comes closer to another cell situated in the direction the cellular user is traveling. When the cellular phone is closer to the next cell, it is switched. This is called the hand-off.

There are two different ways to perform a hand-off. A quick switch from one cell to another, more powerful cell (because the mobile user is leaving the area of the first and traveling into the area of the second) is called a hard hand-off. Only one cell is in full communication with the transmitting phone at a particular time. This is how analog and TDMA-based cellular systems switch users from cell to cell. Calls can be dropped, or disconnected, during hard hand-off.

Another way to switch a user from cell to cell is called a soft hand-off. A soft hand-off is expected to reduce, or even eliminate, dropped calls. Instead of a quick switch between two different cells, a soft hand-off allows the mobile phone to communicate with more than one cell at a time.[24] A switch to another cell will only take place once the phone is well within range of the second, stronger cell. This is how CDMA transfers calls from cell to cell.

The soft hand-off approach is the better of the two, offering continuous coverage. There will be fewer "blips" or missed words in conversation, and less chance of being dropped during the transition.

---

[23]Transmitted signals can bounce off obstacles, creating interference from reflected signals, called "multipath." CDMA's use of a spread spectrum allows these signals to eliminate such problems by utilizing the positives of multipath. Multipath means that signals arrive at the receiver with different time delays. These signals are combined to make a more accurate signal via "rake" receivers. Rake receivers add the dispersed signals together to create a more accurate signal. TDMA, operating on a narrowband system, can't tell the difference between a regular and a bounced (multipath) signal and, as a result, the bounced signal becomes pure interference. (Gilder, George. "Could 'Charles' Upend McCaw?" *Forbes ASAP*. March 29, 1993.)

[24]As the mobile phone travels further away from cell A (the one it is communicating with), another cell (B) will begin to communicate with the mobile phone as well, simultaneously. This simultaneous coverage will continue until the mobile user is well within the range of cell B. ("CDMA, PCS1900, and TDMA Vie for PCS." *EDN Magazine*. November 21, 1996. Pages 72-73).

For the consumer, soft hand-off means that you won't have to incur the expense of reconnection (if there is a per call fee) or repeat what you had said during a conversation interrupted by the "blip" of a hard hand-off between cells. Reception is clearer and uninterrupted.

Community Impact. How does the deployment of the network impact my community?

Communities want their citizens to share in the benefits of wireless technology. But new cell sites have to be set-up for digital cellular to operate, and finding places to put these cell sites is becoming more and more difficult. Consumers don't want towers all over the community interfering with the scenery. Environmental groups are concerned with cell sites going up in parks and other public areas, interfering with the ecology. Fewer cell sites mean less chance of having an unsightly tower set up around your home.

The major point to remember while discussing this subject is that most digital cell sites will be placed in the same towers or other facilities that were set up for analog service. However, in areas that don't already have cell sites (and for companies who don't already provide service to the area), new sites must go up to provide service. CDMA requires less sites than the other technologies to offer the same amount of service.[25] For the time being, however, the cost of installing the CDMA network tends to be more expensive than the other networks.

[25] CDMA requires about 1/3 less cell sites than TDMA-based technology, but most companies that are already established in cellular service may opt to overlay a digital cell site with every analog cell site (a ratio of 1:1). New companies, however, will need to position new cell sites in places where they do not have a cell site already, and can deploy one CDMA site for every 3 analog cell sites (1:3). CDMA seems to have the advantage with its 1:3 ratio overlay (providing service in an area where another service is provided) CDMA sites provide better coverage of weaker spots. ("CDMA, PCS1900, and TDMA Vie for PCS." *EDN Magazine*. November 21, 1996. Pages 72-73). If new development in communities prompts the need to expand service, fewer sites will be required to cover the area. Furthermore, CDMA has the ability to provide more capacity per site, so additional sites beyond the initial overlay will not be required, even if the capacity rises.

VI. Analysis of Report Findings.

In the last section we examined issues that affect consumers. If you've read this far, you are now armed with a wealth of information about the technology, cost, and service. In this last section we've tried to draw some conclusions that will help in selecting the right service for you.

The "Quick Consumer Checklist" on the following page lists the categories that we used to evaluate each technology. The checks represent which technologies had a large advantage over the others. In the event that there was a negligible difference, checks were given to the technologies that provided the highest relative results.

Availability:
Analog cellular is currently the most widely available service. CDMA is considered the dominant digital technology in the U.S. and will be completely deployed across the country in the next few years. CDMA's ability to offer dual-mode switching from digital to analog makes it an attractive option because it guarantees full coverage where CDMA service isn't yet available.

Security:
Digital technology is much more secure than analog. Consumers should rest assured that if they are on a digital network they won't have their cellular phone calls intercepted. CDMA, TDMA and GSM all transmit their signals in code. CDMA's signal is also scrambled which makes it the most difficult to intercept and the most secure.

Enhanced Services:
The new features that are appearing with the advent of digital and PCS phones will make life easier and allow you to do more than has been possible in the past.

Power Needs:
Extended battery life in the newer digital technologies promises that you will no longer have to recharge your battery every night or lose that important call because the battery power is low. CDMA has the advantage over the other digital technologies because it uses the least amount of power in providing service. Another advantage in extending battery life in cellular phones has been innovation in lithium ion batteries.

Signal Quality:
Digital technology offers the potential to provide the best signal quality available for wireless services, with near land-line sound. It eliminates the interference that analog radio waves are susceptible to. CDMA eliminates many of the problems that occur due to signal loss or reflection, utilizing special receivers that make the signal stronger.

Voice Quality:
The signal that is transmitted by digital phones is much closer to land-line quality. Conversations will sound better, both for the cell phone user and the person on the other end. In a recent article it was reported that CDMA comes the closest to approximating land-line quality.

Reliability:
Analog, TDMA, and GSM employ hard hand-off when transferring signals from one cell to another. The hard hand-off may result in more dropped calls. As a result, CDMA has the upper-hand in its use of soft hand-off, which transitions the signal from one cell to another. Fewer interruptions will occur. CDMA also allows for more users on the same frequency, offering less likelihood that the lines will be clogged.

Community Impact:
Digital PCS phones can't use the same cells that are already in place for analog service. New cells must be set up to provide digital PCS service. Fewer CDMA sites are required to cover the same range as the other technologies. CDMA also covers a broader area and allows more users per cell, minimizing the possibility of setting up more towers to cover a given area.

Overall:
CDMA came out ahead of all the other technologies. It led in all but two categories on TRAC's Quick Consumer Checklist. Analog had the upper hand in availability solely because it is deployed in more areas. CDMA was at a disadvantage in signal theft because of its dual-mode operation with analog. Otherwise CDMA came out well ahead in power needs, signal quality, reliability and community impact. As for availability, analog came out ahead, with CDMA coming in second. All of the digital technologies provide significant enhanced services.

For our money, TRAC recommends CDMA, given its rapid expansion in the U.S. and its superior service quality. Although CDMA performed the best in key categories such as signal theft/security, enhanced services and reception, the difference wasn't enough to completely outshine the other digital technologies. In the areas of power needs, reliability, and land use issues, CDMA was the clear winner.

In future studies, TRAC will explore the specific issues of price, value-added services and phone equipment.

Consumer Checklist

Availability	✓			
Signal Theft/Security			✓	
Enhanced Services		✓	✓	✓
Power Needs			✓	
Signal Quality			✓	
Voice Quality			✓	
Reliability (soft handoff)			✓	
Land Use Issues (tower siting)			✓	

VII. GLOSSARY:

Airtime	Time spent connected to a cell.
Alpha-numeric paging messages	Many cellular phones allow for transmitted messages containing letters, digits, and other symbols to be displayed on a handset.
Analog	A continuously variable signal transmitted via radiowaves that represents the sound it is transmitting.
Analog cellular	Wireless phone service utilizing analog technology (see above). Analog signals are transmitted between a cell and handset.
Caller-ID	A feature that displays the originating phone number of the incoming call.
Calling plan	A program offered by a carrier providing specific rates and services.
CDMA	Code Division Multiple Access. A technology for wireless communication that converts sound into digital signals, divides them into packets, and then transmits them in a pseudo-random code.
Cell	An area assigned to a particular antenna. The antenna communicates signals to a mobile handset. Also a term used to refer to a cellular antenna.
Cellular antenna	An antenna positioned atop a tower, covering a cell (see above), that receives and sends signals to cellular handsets.
Cellular phone	A wireless handset that allows a user to communicate via cellular technology to a cell antenna.
Cellular phone service	A type of mobile, wireless service used to communicate via handsets that transmit and receive signals from the cell antenna covering a particular reception area.
Data and fax capability	The ability to send and receive data and faxes.
Digital	A communication technology (or procedure) where information is transmitted as streams of binary 1's or 0's rather than representational radiowaves.
Digital service	Wireless phone service using digital technology.

Dual-mode phone — A mobile phone that has the ability to switch between digital and analog service or between frequencies.

Dual-band phone — A mobile phone that has the ability to switch between different frequencies.

E-mail — Electronic mail. A textual message that is transmitted electronically, often via the Internet.

GSM — Global System for Mobile (or Group Special for Mobile). A digital standard utilizing TDMA technology where certain parts of a mobile phone may only be used by companies who signed a special agreement (see MoU).

Hand-off — The process of transferring a phone call in progress from one cell antenna to another as a user moves from one geographic coverage area to another using a different frequency without interruption of service.

Hard hand-off — Process of transferring a call from one cell to another that occurs abruptly without transition.

Soft hand-off — Process of transferring a call from one cell to another by transitioning from a weaker to a stronger signal between multiple base stations that are in contact with the handset.

Home airtime rate — The charge incurred (typically per minute) while a call is being made in a user's home (or local) calling area.

Incoming service — A call that is being received by a cellular phone.

Local calling area — The area covered by a wireless service provider allowing users to call anywhere within that particular area as part of their basic service without incurring additional long distance or roaming charges. Access and on-air charges may apply.

Local network — A communications system controlled by the local telephone company (typically a local Bell company), separate from the long distance and wireless providers.

Long distance charges — Charges incurred while calling a phone number outside of the local network.

Memorandum of Understanding — (MoU). A voluntary agreement creating a standard for GSM phones.

Multi-mode phone — A mobile phone that has the ability to switch between digital and analog service, frequencies, and/or digital

	standards.
Network Capacity	The average amount of traffic that a circuit (or cell) can handle.
Network compatibility	The ability to use service that is based on a particular standard, operating on a particular frequency.
Paging	A service that allows simple textual or numerical messages to be transmitted to a mobile receiver.
PCS	Personal Communications Service. A type of cellular service, operating on a particular frequency designated by the FCC, that provides for digital cellular transmission and enhanced services such as free first minute of incoming calls, Caller-ID, call waiting, call forwarding, voice mail, and paging.
Power requirements	The amount of power a handset requires to be in continuous contact with the cell, whether it be in standby mode or talk mode.
Prime-time usage	Usage during peak hours, typically between 7am and 7pm, Monday through Friday. Highest per minute rates are charged during this time.
Roaming	Service provided by other networks for a user when they leave their local calling area. Rates are typically more expensive.

Short messaging	See Alpha-numeric paging messages.
TDMA	Time Division Multiple Access. A technology for wireless communication that converts sound into digital signals, places them into packets, divides a frequency into slots, and transmits the packets in ordered, time divided blocks.
Text messaging	See Alpha-numeric paging messages.
Three-way calling	A service that allows a user and two other callers to simultaneously talk on the same line.
Voice mail	Telephone messages that are digitally recorded and stored.

VIII. CARRIERS IN TOP TWENTY MARKETS

CARRIERS IN TOP MARKETS			
Market	**Carriers**	**Technology**	**Contact**
Atlanta	AirTouch	Analog/CDMA	(800) 235-5611
	BellSouth	Analog/GSM	(800) 586-5566
	MCI	Analog	(800) 230-4185
	Powertel	GSM	(888) 611-6119
Baltimore-Washington	Bell Atlantic	Analog/CDMA	(800) 255-BELL
	Cellular One	Analog/TDMA	(800) CELL-ONE
	MCI	Analog	(800) 230-4185
	Sprint Spectrum	GSM	(800) 480-4PCS
Boston	Bell Atlantic	Analog/CDMA	(800) 255-BELL
	Cellular One	Analog/TDMA	(617) 462-7000
	MCI	Analog	(800) 230-4185
	Sprint PCS	CDMA	(800) 480-4PCS
Chicago	Ameritech	Analog/CDMA	(800) 221-0994
	AT&T Wireless	TDMA	(888) 290-4613
	Cellular One	Analog/TDMA	(800) 552-1551
	MCI	Analog	(800) 230-4185
	PrimeCo	CDMA	(800) 801-2100
Cleveland	AirTouch	Analog/CDMA	(800) 247-8682
	Ameritech	Analog/CDMA	(800) 221-0994
	GTE Wireless	Analog/CDMA	(800) 444-3888
	MCI	Analog	(800) 230-4185
Dallas	AT&T Wireless	Analog	(888) 290-4613
	GTE Wireless	Analog	(800) 444-3888
	PrimeCo	CDMA	(800) 801-2100

	Southwestern Bell	Analog/TDMA	(800) 331-0500
	Sprint PCS	CDMA	(800) 480-4PCS
Denver	AT&T Wireless	TDMA	(888) 290-4613
	AirTouch	Analog	(800) 238-7848
	MCI	Analog	(800) 230-4185
	Sprint PCS	CDMA	(800) 480-4PCS
	Voice Stream	GSM	(303) 383-5700
Detroit	AirTouch	Analog/CDMA	(800) 247-8682
	Ameritech	Analog/CDMA	(800) 221-0994
	MCI	Analog	(800) 230-4185
Houston	Aerial	GSM	(888) 237-4251
	GTE Wireless	Analog	(800) 444-3888
	Houston Cellular	Analog/TDMA	(281) 444-4444
	PrimeCo	CDMA	(800) 801-2100
	Southwestern Bell	Analog/TDMA	(800) 510-2355
Los Angeles	AirTouch	Analog/CDMA	(800) 868-2414
	GTE Wireless	Analog	(800) 444-3888
	L.A. Cellular	Analog/TDMA	(800) LAS-BEST
	MCI	Analog	(800) 230-4185
	Pacific Bell Mobile	GSM	(888) 668-4335
	Sprint PCS	CDMA	(800) 480-4PCS
Miami	AT&T Wireless	TDMA	(888) 290-4613
	BellSouth Cellular	Analog	(800) 586-5566
	MCI	Analog	(800) 230-4185
	PrimeCo	CDMA	(800) 801-2100
	Sprint PCS	CDMA	(800) 480-4PCS
Milwaukee	Ameritech	Analog	(800) 221-0994
	Cellular One	Analog/TDMA	(800) CELL-ONE

MCI	Analog	(800) 230-4185
PrimeCo	CDMA	(800) 801-2100
Sprint PCS	CDMA	(800) 480-4PCS

Minneapolis/St. Paul	Aerial	GSM	(888) 237-4251
	AirTouch	Analog	(800) 247-8682
	AT&T Wireless	Analog	(888) 290-4613
	MCI	Analog	(800) 230-4185
	Sprint PCS	CDMA	480-4PCS
New York City	AT&T Wireless	Analog/TDMA	(888) 290-4613
	Bell Atlantic	Analog/CDMA	(800) 255-BELL
	MCI	Analog	(800) 230-4185
	Omnipoint	GSM	(800) 289-6664
	Sprint PCS	CDMA	(800) 480-4PCS
Philadelphia	Bell Atlantic	Analog/CDMA	(800) 255-BELL
	Comcast Mobile	Analog/TDMA	(800) 234-9666
	MCI	Analog	(800) 230-4185
	Sprint PCS	CDMA	(800) 480-4PCS
Phoenix	AirTouch	Analog	(800) 626-6611
	AT&T Wireless	TDMA	(888) 290-1613
	Sprint PCS	CDMA	(800) 480-4PCS
Pittsburgh	Aerial	GSM	(888) 237-4251
	AT&T Wireless	Analog	(888) 290-4613
	Bell Atlantic	Analog/CDMA	(800) 255-BELL
	Sprint PCS	CDMA	(800) 480-4PCS

San Diego	AirTouch	Analog	(800) 247-8683
	GTE Wireless	Analog	(800) 444-3888
	MCI	Analog	(800) 230-4185
	Sprint PCS	CDMA	(800) 480-4PCS
San Francisco/Oakland	Cellular One	Analog/TDMA	(800) CELL-ONE
	GTE Wireless	Analog	(800) 444-3888
	MCI	Analog	(800) 230-4185
	Pacific Bell Mobile	GSM	(888) 668-4335
	Sprint PCS	CDMA	(800) 480-4PCS
St. Louis	Ameritech	Analog	(800) 221-0994
	Southwestern Bell	Analog/TDMA	(800) 331-0500
	Sprint PCS	CDMA	(800) 480-4PCS

Information was gathered from company home pages on the Internet, trade publications, trade associations, and calls to numbers listed above. The above chart is, to the best of our knowledge, a correct representation of information pertaining to each market.

IX. TRAC PUBLICATIONS

TeleTips – TRAC's Residential Long Distance Comparison Chart

Twice a year, TRAC produces Tele-Tips™ Residential Long Distance Comparison Chart, the only independent source for information on residential long distance calling plans. It includes comparisons of rates, plan descriptions and calling time periods. The studies cover seven major long distance companies and includes consumer-friendly tips, detailed descriptions of plans, and a comparison chart of features and services. The chart can be obtained by sending $5.00 and a self-addressed, stamped envelope ($0.55) to TRAC at P.O. Box 27279, Washington, DC 20005.

TeleTips – TRAC's Small Business Long Distance Comparison Chart

Twice a year, TRAC also produces Tele-Tips™ Small Business Long Distance Comparison Chart, the only independent source for small businesses who want to save money on their long distance bills. It compares rates for eight of the leading small business long distance providers. The Small Business Tele-Tips™ chart includes comparisons and detailed descriptions of plans, including a Features and Services Comparison Chart with valuable information on other aspects of the long distance carriers' plans. The chart can be obtained by sending $7.00 and a self-addressed, stamped envelope ($0.55) to TRAC at P.O. Box 27279, Washington, DC 20005.

TeleTips – A Consumer's Guide to Cellular Telephone Service

TRAC publishes a comprehensive study on cellular service that compares the technologies used in digital and analog service and how they affect consumers. Additionally, TRAC explains the differences between the technologies and provides a comparison chart. The study can be obtained by sending a $7.95 and $1.50 postage to TRAC at P.O. Box 27279, Washington, DC 20005.

TeleTips – A Consumer's Guide to Long Distance and Local Directory Assistance Calling

A tipsheet for consumers who utilize directory assistance, whether it be from their local carrier or their long distance carrier. The guide contains valuable tips and facts to help consumers make smart choices. The guide can be obtained by sending a check for $1.00 and a self addressed, stamped envelope ($0.32) to TRAC at P.O. Box 27279, Washington, DC 20005.

After Divestiture: What the AT&T Settlement Means for Residential and Small Business Telephone Service.

Written by TRAC founder Samuel A. Simon, *After Divestiture* discusses how consumers are faced with changes in switching and other telecommunications technologies. Simon provides essential information and analysis on the pre- and post-divestiture worlds. A copy can be obtained by sending a check for $35.00 and $3.00 postage (total $38.00) to TRAC at P.O. Box 27279, Washington, DC 20005.

Mattix, Edward

From: Pindell, Ashley
Sent: Thursday, October 09, 1997 3:02 PM
To: Mattix, Edward; Murphy, Thomas (Kansas City)
Subject: FW: TRAC Report Advises Consumers: Do Your Homework... (Profile LO4025 4025)

From: prof_luceadm_LO4025@mailgate.rtinews.com[SMTP:prof_luceadm_LO4025@mailgate.rtinews.com]
Sent: Thursday, October 09, 1997 2:23 PM
Subject: TRAC Report Advises Consumers: Do Your Homework... (Profile LO4025 4025)

TRAC Report Advises Consumers: Do Your Homework Before Picking Cellular Service; CDMA Digital Standard Compares Best
Received Time: Oct 09 1997 15:14:01
Origin: BZW

WASHINGTON (Oct. 9) BUSINESS WIRE -Oct. 9, 1997--Consumers need to do their homework before picking a cellular telephone service, according to a newly released study by the Telecommunications Research and Action Center (TRAC), a non-profit Washington based consumer group.

TRAC, publisher of TeleTips(TM), has been educating consumers on the changes in the telephone and telecommunications industries since 1980. In this first-ever TRAC report on cellular service, the study reviews a number of new technologies and concludes that the technology called CDMA compares the best.

"Picking a cellular service used to be a choice between two available companies, each offering the same technology and essentially the same service. Today, a growing array of providers and technologies are available, and consumers need more information and sophistication to make smart choices," said Samuel A. Simon, counsel to TRAC. "It is not easy to make the best choice."

The TRAC report provides an in-depth explanation and evaluation of the four different cellular standards -- analog, TDMA, GSM and CDMA -- and evaluates each one based on voice quality, reliability, pricing plans, enhanced services and availability.

The report recommends consumers undertake a "self-assessment" to determine how they expect to use the phone and what services and features are likely to be most important. It then outlines the questions for consumers to ask, focusing on the new digital technologies.

"All cellular service is not the same," Simon said. "It's hard to know which newspaper ad is telling the truth when every company is claiming to offer the most state-of-the-art service on the largest network."

Of the four technologies, analog, GSM, TDMA and CDMA, the report states that CDMA came out ahead in almost every category that TRAC compared. Among the recommendations in the report are:

- Availability will matter a lot more to consumers who travel a great deal with their cellular phone, than to consumers who stick closer to home. Analog cellular service is currently available in most areas of the country, and the more advanced CDMA service is expected to be the most widely available digital service in the future. Of the other two digital services, GSM will be offered in most major cities but not in outlying areas, and TDMA is expected to be available except in some western states.

- Privacy is another area in which phone service providers compete. Because analog systems basically use radio transmissions which can be

easily overheard, many wireless phone users want more security for their conversations. If consumers intend to use their wireless phone for emergencies, privacy probably won't matter much. But if security is an issue, any of the digital systems will give more protection than an analog system. GSM or TDMA, therefore, might be a good choice. CDMA, which was originally developed for military communications and actually scrambles each transmission, offers the highest level of security as well as the best overall sound quality.

The TRAC study developed a Quick Consumer Checklist to help buyers find their way through the maze of cellular claims and counter-claims.

Analog offers by far the greatest availability, but TRAC found that all three of the digital technologies provide significant advantages over analog when it comes to services. Among the digital services, CDMA performed the best in key categories such as signal security enhanced service, and reception, but the difference wasn't enough to outshine completely the other digital services. When it comes to power needs and reliability, however, CDMA was a clear winner. That's important, because it means that with CDMA consumers will spend less time recharging batteries and run much less of a risk that calls will be interrupted or dropped while traveling.

Until digital systems are more widely established, a dual-mode phone that switches back and forth between digital and analog cellular services may be the right choice for most consumers. But given CDMA's rapid expansion in the U.S. and its superior service quality, CDMA today looks to be the best bet for consumers over the long term.

In addition to the Quick Consumer Checklist, the report contains a listing of the major service providers and the technology they offer in the top markets, with phone numbers on how to reach each. The report also contains tips on how to pick the right pricing plan for your calling needs.

Copies of the report are available from TRAC, P.O. Box 27279, Washington, DC 20005, for $7.95, plus $1.50 for postage and handling.

Quick Consumer Checklist

	Analog	GSM	CDMA	TDMA
Availability	X			
Signal Theft/Security			X	
Enhanced Services		X	X	X
Power Needs			X	
Signal Quality			X	
Voice Quality			X	
Reliability (soft hand off)			X	
Land Use Issues (tower siting)			X	

EXECUTIVE SUMMARY

How do I pick the right cellular service? Which company and pricing plan is best for me? How do I decide which of the new technologies I

should buy?

As more cellular companies enter the market, and as more and more choices develop, consumers need to know how to be smart shoppers. Unlike long distance service, where three or four companies provide identical service nationwide, cellular is more like local telephone and cable service with often widely varying services and technologies in different markets.

The following report, prepared by the Telecommunications Research and Action Center (TRAC), provides a consumer road map for making some of the most important decisions in picking a cellular service. The first half of the report looks at which questions to ask and the second half evaluates consumers' needs and how the various technologies stack-up.

Selecting the cellular phone service that best meets your needs is at a minimum a two-step process. First, you need to pick a service provider. Second, you need to select a pricing plan which best meets your needs. Just as it is true with long distance, there is no single answer to the question, "Which cellular phone service is the best?" The answer is, "it depends."

How you select your provider and pricing plan depends on how you plan to use your cellular phone. If most of your calls will be local, issues like network compatibility and roaming charges will be less important than if you are someone who relies on their phone when they travel for work. The more sophisticated cellular phones now offer voice-mail, Caller-ID and other more sophisticated services which are invaluable if you need your phone for work, but might prove less necessary if you only use your cellular service in case of emergency.
Do a Self-Assessment

TRAC suggests that first you do a self-assessment. If you are a first-time cellular user, talk to friends who have used cellular a long time. If you have service now and are looking to change or upgrade, you probably can answer these questions from your own experience.

- What is the primary reason for purchasing a cellular phone? (e.g., personal safety, to keep in touch with children and relatives, business in town, business away from home etc.)?

- Will you use the phone when you are out-of-town or primarily in your local calling area?

- Will you spend more than 60 minutes a month on your cellular phone?

- Is the majority of the time you plan to spend on the phone during what is considered peak calling times? (7 a.m. – 7 p.m.)

- Would you benefit from having a phone which provides more advanced features like voice-mail, Caller-ID, and the ability to send and receive text messages? Questions to Ask:

Once you have completed the self-assessment you will be able to evaluate each of the cellular services and determine whether they meet your needs. Service questions to consider include the following:

- Do you need an analog or digital service? What is the difference? What type of service is available? Are other services expected to be available soon?

- What is the difference between the digital technologies (CDMA, GSM, TDMA) and does it effect your decision?

- Does the technology impact where and when you can use your phone? (That is, can you roam or use the phone outside your calling area

easily?)

- What type of technology will give you the best overall coverage or service?

- What type of calling plan will best suit your needs, and does the technology effect that cost? How do the different cellular phone technologies compare?

The TRAC Consumer Report evaluated the different technologies when it comes to meeting the needs of consumers. TRAC looked at analog cellular, Code Division Multiple Access (CDMA), Time Division Multiple Access (TDMA) and Global System for Mobile (GSM).

Based on the categories discussed below, the report concludes that the emerging CDMA standard, and therefore the cellular systems that are based on it, come out significantly ahead overall. TRAC based its conclusions on the following findings:

- Service availability -- Analog cellular service is the most widely available service at the present time. Digital networks are still being built-out. Of the digital networks in the U.S., CDMA is considered the predominant service.

- Privacy and security -- Digital service is better able to guarantee privacy and security than analog because it transmits signals in code. CDMA networks are the most secure because they both transmit in code and the code is scrambled.

- Enhanced service options -- Digital service offers a more extensive package of services than analog cellular. Both GSM and CDMA services are competitive.

- Power requirements -- Digital technologies in general require less power than analog cellular. CDMA requires the least amount of power of the digital services and provides the longest talk and stand-by time.

- Voice quality -- Because of its digitized signal, digital phones are able to provide better voice quality than analog. Of the digital technologies, CDMA is found to have the closest to land-line quality service.

- Signal quality -- Digital is better than analog and among the digital technologies CDMA comes out ahead because its broader range signal provides the best quality.

- Reliability -- Analog, GSM and TDMA all use hard hand-off when changing from one cell signal to another, sometimes resulting in an interruption in service. CDMA utilizes the soft hand-off which allows for signal overlap resulting in no interruption in transmission and therefore is more reliable.

- Community Impact -- The lower power demands of CDMA mean that fewer cell sites will need to be installed in a community. The advantage of fewer cell sites with broader coverage means less environmental and visual pollution. It also means that the systems can be build more quickly.

-0- ahc/sf* gdr/sf

CONTACT: Telecommunications Research and Action Center
Geoff Mordock or Samuel A. Simon, 202/408-1130

or 800/527-9305

KEYWORD: DISTRICT OF COLUMBIA

INDUSTRY KEYWORD: COMPUTERS/ELECTRONICS COMED TELECOMMUNICATIONS
PRODUCT Today's News On The Net - Business Wire's full file on the Internet

with Hyperlinks to your home page.
URL: http://www.businesswire.com

The Yankee Group Announces Results from their 1996 Mobile User Survey

BOSTON, MA, May 31, 1996

The Yankee Group is pleased to announce that results from the 1996 Mobile User survey, the largest wireless survey of its kind, have been tabulated, and will be available to all Yankee Group clients immediately with information on penetration rates, attitudes towards wireless technology, and usage of telecommunications services and consumer electronics technologies at both home and work. It includes questions on respondents' work environment, mobility patterns, and their interests in wireless devices and services. The survey's four main areas of wireless technologies include cellular, paging, portable computing, and personal communicators.

This year, we received over 2,000 responses in the United States. Some highlights include:

Cellular/PCS

The typical cellular phone user makes 10 phone calls every week.

91% of consumers are satisfied with their current cellular service.

However, 58% of cellular users agree having nationwide coverage is important.

The average price paid for a cellular phone is $142.

At what price point would cellular subscribers use their service significantly more? 15% would if prices were 10% less; 77% if 50% less.

Wireless Data/Paging

48% of pager users carry their pager on weekends after work.

61% of portable computer users are interested in using wireless data services.

66% of portable computer users think it's important to have ubiquitous, nationwide wireless data coverage.

31% feel it is still too complicated to send data wirelessly and 60% believe it is too expensive.

Mobile Computing

26% of portable computer users choose brand as the most important factor when purchasing a portable computer.	38% of portable computer users' devices are supplied by their employer.	50% of portable computer users regularly connect to a wireline modem for fax and E-mail.	The average user employs his or her portable computer for business 13 hours every week.	50% of portable users are interested in having voice capabilities integrated directly into their computer.

Lifestyle/Workstyle

Our average respondent works around 51 hours per week at both a primary and secondary workspace.	The average respondent spends 39% of their time away from their primary workspace.	The mean commuting time for our average respondent is 29 minutes.	60% of business travelers spend more than 15 days per month on the road.

The Yankee Group believes the Mobile User Survey is unique in the industry, because:

- Its questions bridge mobile communications, mobile computing, and mobile data;
- Its respondents are queried about their personal and business use of wireless devices; and
- In addition to products and services, there is an extensive set of questions on mobility patterns, lifestyle, and workstyle.

The survey was sent in two sections - - the **General User Survey**, and the **User-Specific** survey. The **General User Survey**, is a representative sample and its focus is extremely in-depth. In fact, we have received information about both the respondent, and his or her spouse in one, eight page survey. The **General User Survey** allows us to draw conclusions about penetration rates, attitudes towards the technology, and usage at both home and at work.

The second section, the **User -Specific** Survey was sent to 2,000 homes of known users of pagers, cellular phones, or portable computers. This half of the survey -- 24 pages long -- goes to preselected individuals on a voluntary mail panel who are existing mobile users: that is they use either a pager, a cellular phone, or a portable computer. We use this oversampling methodology to obtain a statistically significant sample of existing mobile users (since penetration of these devices is still around 10 percent), and to have this base to compare to the representative sample. This year we received feedback from 616 cellular phone users,381pager users, and 171 portable computer users from around the country.

In the coming months, Yankee Group White Papers and Reports will feature data from the survey. One White Paper, expected in Q2-Q3 1996 "Mobility in the Late '90s" will be based on data from the Mobile User survey to understand mobility patterns near and far, among the ever increasing ranks of mobile users.

For further information on this survey and other Yankee Group research contact your sponsor by clicking the Doing Business With Us button.